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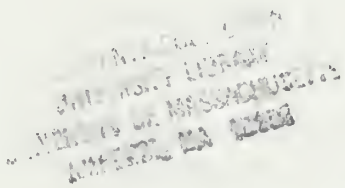
SURVEILLANCE OF SEVERE PEDIATRIC UNDERNUTRITION

(SSPUN) PROJECT

MASSACHUSETTS



Commonwealth of Massachusetts
MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

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Final Report, 1994

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EXECUTIVE SUMMARY

Massachusetts Surveillance of Severe Pediatric Undernutrition (SSPUN) Project

Purpose

The goals of the Massachusetts SSPUN Project were:

1) To estimate the number and proportion of children with severe undernutrition (SPUN) living in an urban and rural area of Massachusetts.

2) To describe the medical, sociodemographic and program participation characteristics of undernourished children and their families.

3) To develop and test a surveillance system to find and report children with severe undernutrition.

Methods

The Massachusetts SSPUN project was conducted by the Bureau of Family and Community Health of the Massachusetts Department of Public Health (MDPH), under a Cooperative Agreement with the Centers for Disease Control (CDC). A total of 96 health and community agencies in the urban (Roxbury and North Dorchester) and rural (South and Central Berkshire County) catchment areas participated in the SSPUN project. Participating sites included hospital inpatient services and emergency rooms, community health centers and primary care outpatient clinics, private pediatricians' offices, Massachusetts Growth and Nutrition Clinics, sites of the Special Supplemental Food Program for Women, Infants, and Children (WIC Programs), Head Start programs, and rural area kindergartens and private day care centers. Staff at participating sites reported all children who met criteria for severe undernutrition[1] during a 12-month period beginning in February 1989. SSPUN staff interviewed a subset of these families to document medical, sociodemographic and program participation characteristics; and made appropriate referrals to community-based services.

---

[1]Case criteria for severe pediatric undernutrition, established by the CDC, included children living in the catchment areas who were 6 months to 6 years of age during the study period and had a weight-for-height less than the third percentile on reference growth charts or a hematocrit less than 25% or hemoglobin less than 8 mg/dl or weight loss of at least 10%, or clinical symptoms of kwashiorkor or micronutrient deficiency.

Results

1) **Prevalence of Undernutrition.** A total of 175 children with indicators of severe pediatric undernutrition were reported to the SSPUN project during the 12-month study period, estimated to be one percent of children aged 6 months to 6 years living in the catchment areas. The proportion of undernourished children who had been screened (weighed and measured) at participating sites varied by type of site. Approximately 6-10% of children screened in hospital inpatient services met SPUN criteria, as well as 4% of children screened in an urban emergency room, and 33% of children screened in the Massachusetts Growth and Nutrition Clinics. Less than 1.0% of children screened in community-based health sites and agencies in both urban and rural catchment areas met criteria for SPUN.

2) **Characteristics of Children and Families.** Most (61%) of children identified in the SSPUN project were less than two years old. Racial/ethnic composition of children in the SPUN study group reflected that of the catchment areas. Both medical and social risk factors for undernutrition were reported in SPUN cases. Of the 82 cases for whom risk factors were identified, 44% (36 cases) had risk factors that were medical in origin (low birth weight, prematurity, chronic or recurring disease or hospitalization); 22% (18 cases) were linked with a family social stress such as poverty, non-participation in benefit programs, inadequate food or family illness and death; and 34% (28 cases) appeared to be of mixed medical and social etiology.

Recommendations

The Massachusetts SSPUN Project identified 175 children aged 6 months to 6 years, meeting criteria for severe undernutrition in two catchment areas, with these areas representing only three percent of children statewide in that age group. Medical and social characteristics of these children and their families suggested public health surveillance and programs should ensure that children meeting undernutrition criteria be routinely identified, evaluated, and referred as appropriate to community-based interdisciplinary services. Key recommendations based on findings of the Massachusetts SSPUN project were:

- To identify, report, and ensure the evaluation of undernourished children as part of existing screening activities at MDPH community-based programs including community health centers, WIC, Early Intervention, and High Risk Infant and Family Programs.

- To simplify indicators of undernutrition so that they are consistent with information routinely collected in primary care settings.

- To continue SSPUN project surveillance activities at sites serving children who may not routinely use primary care and public health programs, including hospital emergency rooms and inpatient services and, in rural areas, kindergartens and daycare programs.

- To use nutritional surveillance of undernutrition to identify and assess not only children but families at risk and refer to appropriate community-based health, nutrition and social services.

- To support and strengthen the coordination of a network of interdisciplinary services to evaluate and treat medical and social problems of undernourished children and their families, including the Massachusetts Growth and Nutrition Clinics and community-based early childhood service providers.

- To develop the capacity of community-based providers of early childhood services to identify, treat and coordinate care for undernourished children, through training and technical assistance.

- To expand options for reimbursement of multidisciplinary assessment and treatment of undernutrition through community-based services.

- To conduct research on short and long-term consequences of undernutrition in U.S. children, including illness, learning delays, and mortality.

I. INTRODUCTION AND BACKGROUND

I. INTRODUCTION AND BACKGROUND

This report describes the Massachusetts (MA) Surveillance of Severe Pediatric Undernutrition (SSPUN) Project, conducted by the MA Department of Public Health, Bureau of Family and Community Health. The SSPUN project in Massachusetts was implemented from October 1987-December 1990 as a three-year demonstration project, through a Cooperative Agreement with the Centers for Disease Control (CDC). Similar projects were implemented in Mississippi, Louisiana and Florida.

The goals of the Massachusetts SSPUN project were:

1) To estimate the prevalence of severe undernutrition in children ages 6 months to 6 years in a rural and an urban catchment area of the state.

2) To describe the risk factors associated with severe pediatric undernutrition, specifically, the sociodemographic, medical and program participation characteristics of severely undernourished children and their families.

3) To develop and test a surveillance system, in order to determine the type of community and/or hospital-based surveillance that could most effectively identify SPUN children.

Severe pediatric undernutrition (SPUN) is a public health issue encompassing social, economic, medical, and political concerns, all of which have implications for the allocation of resources to address the problem. Government's role in preventing and treating severe pediatric undernutrition is broad and is justified by at least three considerations. First, the health consequences of SPUN for an individual infant or child are grave but preventable. Early identification of the child at risk for SPUN can prevent serious medical complications through prompt referral and intervention. Second, the populations served by public agencies include groups at risk for SPUN. Public agencies are frequently the primary providers of medical and preventive services for low-income families and of means-tested financial and nutritional benefit programs that are adjuncts to treatment of SPUN. Finally, public sentiment supports government's role in addressing childhood malnutrition; it is a manifestation of a caring society.

Pediatric Undernutrition as a Social Problem

Many people feel that pediatric undernutrition at any prevalence is unacceptable in a society of abundant food and state-of-the-art health care. The recent history of the social problem aspects of pediatric undernutrition is a rich one. The 1967 Citizen's Board of Inquiry shocked Congress and the American people with the specter of starving children in the deep South (Mayer, 1990). The White House Conference on Food and Nutrition (1969) and the formation of the Select Committee on Hunger followed, as did important changes in

nutrition policy and nutrition monitoring. These included establishing the Special Supplemental Food Program for Women, Infants and Children (WIC), enhancing the Food Stamp and School Lunch programs, and implementing the Ten State Nutrition Survey, the National Health and Nutrition Examination Survey (NHANES), and the Centers for Disease Control (CDC) Pediatric Nutrition Surveillance System.

Following a period of relative complacency over domestic food security, the early 1980s saw increasing poverty and unemployment, a dramatic rise in housing costs, and an increased demand for emergency food services (Mayer, 1990). Regional and national "hunger" studies from the 1980s are numerous and many include references to pediatric undernutrition as one consequence of economic insecurity (Physicians' Task Force on Hunger in America, 1985). These studies, frequently in literature written for public and political consumption, have successfully fueled the 1980's debate over the role of public policy in alleviating hunger and malnutrition.

In 1987, Congress heard reports of severe primary malnutrition of children seen in urban hospitals (Listernik, 1985), and highlighted the need for more and better information about childhood undernutrition in the U.S. (Trowbridge and Wong, 1990). National concern about undernutrition was supported by analyses of NHANES I and II (Jones, 1985) and national pediatric nutrition surveillance data (CDC, 1989(b)) that documented lower growth measures and a high prevalence of iron deficiency anemia in low-income children.

SPUN as a Health Condition

The term "SPUN" as used in this report includes wasting, severe anemia, weight loss and/or micronutrient deficiency in infants and young children (Trowbridge and Wong, 1990). The case definition for SPUN is outlined in Appendix A. Consequences of SPUN are several. In severe cases, death from starvation or dehydration occurs. Protein malnutrition may lower resistance to infectious disease, initiating or perpetuating a cycle of illness and wasting, and may lead to serious morbidity (Chen 1983, Torun and Viteri, 1984). Compromised iron status may increase susceptibility to infection (Cook, 1986). Iron-deficiency anemia can also increase vulnerability to lead poisoning, which in turn may affect stature and cognition and is life-threatening when severe (Schwartz 1986, 1987; Angle and Kuntzelman, 1989). If inadequate nutrition continues over a prolonged period, growth stunting may ensue. Other long-term effects of SPUN may include behavioral problems and cognitive delays leading to poor school performance and decreased productivity (Allen, 1990).

When SPUN is treated early, catch-up growth may be promoted (Bithoney, 1989; Kristiansson, 1987) and developmental consequences ameliorated (Pollitt, 1987). Through screening, early identification and prompt referral of children to necessary medical, social and financial services, it may be possible to prevent severe undernutrition and its consequences.

Risk Factors for SPUN

Risk for SPUN may be influenced by social, economic and health-related factors affecting the child and family. Our knowledge of potential risk factors for SPUN in U.S. children comes largely from cross-sectional or descriptive studies of children admitted to clinics or hospitals for treatment of failure-to-thrive (FTT)[2]. Household characteristics of FTT cases suggest that FTT occurs predominantly, though not exclusively, in low-income households (Massachusetts Department of Public Health (MDPH) 1985, 1993; Pollitt, 1975). Only one-third of FTT cases identified in the Massachusetts Growth and Nutrition Clinics were from families with incomes over 200% of federal poverty guidelines (MDPH, 1993). Studies of low-income groups corroborate the association of undernutrition with socioeconomic status (Centers for Disease Control (CDC), 1972; Guyer 1983). Potential biases in the association of FTT with low family income should be noted. Children with FTT seen in hospitals and clinics may be predominantly poor to begin with, since upper-income children may be unlikely to use public clinics located in low-income areas or obtain primary health care in an emergency room. Thus, estimates of FTT may underestimate prevalence in middle and high income families.

Regardless of income level, families of children with FTT exhibit other problems that are frequently addressed by public agencies. Maternal factors, including low maternal age and education, inadequate prenatal care, and prenatal drug, alcohol, and tobacco use, are associated with low birthweight, congenital defects, infant morbidity, and infant developmental delays (CDC, 1989(a)). These prenatal factors are frequently within the purview of public agencies, as funders of community services or as grantees themselves, and all may be associated with disordered parent-child interactions, feeding problems, and malnutrition (Bithoney, 1983; Rathbun, 1987; Frank, 1988).

Some cases of FTT are related to acute or chronic medical conditions that occur independently of family socioeconomic status and that affect feeding and growth. Providing services to children with special health care needs and their families is also a responsibility of public agencies (New England Serve, 1989; USDHHS, 1987).

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[2]Failure-to-thrive is a diagnosis generally applied to children with a weight-for-age less than the fifth percentile or 80-85 percent of median on reference growth charts, or showing a persistent deviation from the normal growth curve (Rathbun, 1987). Children with SPUN, with a weight-for-height less than the third percentile, are a subset of children with FTT.

Pediatric Undernutrition in Massachusetts

History. In 1982, public concern about malnutrition in Massachusetts received enormous impetus from observations that the number of children presenting with failure-to-thrive to an inner-city hospital had doubled relative to the previous year (MDPH, 1983). The state legislature subsequently commissioned the Massachusetts Department of Public Health (MDPH) to carry out the Massachusetts Nutrition Survey (MNS). The MNS documented that stunting, anemia, and overweight were significantly more common among a sample of largely low-income children attending community health centers than they were in reference populations (Guyer, 1983). These findings prompted the legislature to fund efforts to reduce low birthweight, infant mortality, and childhood malnutrition. In 1984, seven Growth and Nutrition clinics were established to treat children with FTT; the MDPH Office of Nutrition was created to conduct nutrition monitoring and surveillance; state dollars were allocated to increase the federally-funded WIC caseload; and a Task Force on Prevention of Low Birthweight and Infant Mortality was convened.

Statewide Data. Information related to children with severe pediatric undernutrition in Massachusetts comes primarily from the Growth and Nutrition clinics, from Head Start programs in the state's pediatric nutrition surveillance system (PEDNSS), and from the state's natality profiles and census projections.

Growth and Nutrition Clinic Data. Children referred for evaluation and treatment at GN clinics do not always meet SPUN project case definitions because different diagnostic criteria apply. Of 1286 children diagnosed with FTT at the GN Clinics from July 1, 1985 through June 30, 1989, 474 (37.1%) had a weight-for-height below the third percentile at the initial visit (MDPH, 1993). Nonetheless, the GN clinic caseload represents a diverse group of small, growth-faltering, or otherwise undernourished children. Five-year data (FY 85-89) from GN clinics (MDPH, 1993) show that social and economic factors are documented more often than medical factors in association with growth delay. Minority race, poverty, and single parent-status are common but not universal among FTT cases. Screening for SPUN is essential even among children who are not in groups commonly considered high risk, including white, non-poor, and two-parent households.

- 31.3% of 1286 FTT cases had social and economic risk factors documented in addition to a medical condition; 61.3% of cases reported non-organic factors alone.
- Over half of FTT cases were white, although black and Hispanic children were overrepresented relative to the state's population.
- Over a quarter of households of FTT cases had incomes above 200% of poverty.
- Over half of FTT cases were from two-parent families.

Head Start Data. Data on children from a non-clinical population are available from Nutrition Counts, the Massachusetts Pediatric Nutrition Surveillance System (MDPH 1988, 1989, 1990). Among 3552 Head Start children measured during FY90, 20 (0.6%) met SSPUN case criteria, 17 having weight-for-height below the 3rd percentile when plotted on an NCHS growth chart, and three having severe anemia (sickle-cell status unknown).[1] These children were identified in 11 of the 19 Head Start programs participating in Nutrition Counts, and included low-income children from inner-city Boston, smaller cities in the state, and rural areas. These Head Start data indicate that screening for SPUN should take place in geographically diverse areas.

Low Birthweight Data. Low birthweight, a risk factor for poor growth and development, occurred in 6.0% of live births in Massachusetts in 1988 (MDPH, 1988). While this figure compares favorably to the national prevalence of low birthweights, which was 6.9% (NCHS, 1988), it obscures discrepancies among low and high-income areas of the state, and between blacks and other racial groups. The proportion of 1988 Massachusetts births less than 2500g was 12.5% among blacks, 7.9% among Hispanics and 11.2% among other racial groups, compared with 5.1% among whites (MDPH, 1988).

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[1]Source: Massachusetts Department of Public Health, Bureau of Family and Community Health, 1991.

II. SURVEILLANCE METHODS

II. SURVEILLANCE METHODS

In order to accomplish the goals of the SSPUN project, the Massachusetts SPUN surveillance system was designed to complete the following tasks:

- To identify SPUN cases in a rural and urban catchment area using active case-finding methods;
- To report SPUN cases to the central office at the Massachusetts Department of Public Health;
- To complete a case interview with the parent or guardian of the SPUN child;
- To use the surveillance and interview data for referral of children and families to services, for site reports identifying children at risk, for program planning and for policy development.

A flowchart of the SPUN surveillance system is included in Appendix B.

Catchment Areas

The SSPUN system was implemented in an urban and a rural catchment area of Massachusetts. Two Boston neighborhoods, North Dorchester and Roxbury, comprised the urban area. South and Central Berkshire County, on the western border of Massachusetts, comprised the rural area. Maps of the catchment areas and lists of urban census tracts, urban zip codes and rural towns are included in Appendix C.

The urban catchment area for the Massachusetts SSPUN Project included two Boston neighborhoods: Roxbury and North Dorchester. These two neighborhoods are contiguous and include the poorest census tracts in Boston (Table 1). An estimated 12,025 children under five years lived in this area, based on 1990 Census data. Of children under five, 44.6% lived below 100% of poverty in 1980 (1980 Census)[2]. Minority groups predominate; the population is 54% black, 18% Hispanic, 7% other, and 21% white (1990 Census). These communities were noteworthy for their contribution to Boston's high infant mortality rate (IMR) of 14.0 per 1000 live births in 1988. Both Roxbury and North Dorchester had an IMR of about 20 per 1000 live births, among the highest in Boston neighborhoods. At 12.4%, the proportion of low birthweights in these neighborhoods was greater than in the city at large (9.5%, 1988), and was double that for the state (6.0%, 1988).

The rural catchment area for SSPUN, South and Central Berkshire County, had 3,302 children under five years of age (Table 1) (1990 Census). The 23 towns in South and Central Berkshire include Pittsfield, an urban center with a population of approximately

[2]1990 Census poverty statistics were unavailable by census tract at the time of analysis.

23,000 (1990 Census). The racial composition of the rural catchment area is largely white. The percent of children under five years living below poverty ranged from 17% to 43% among the communities of Central Berkshire County and was 35% in South Berkshire County as a whole (1980 Census). The percent of low birthweights in the rural SSPUN catchment area towns (5.9%, Central Berkshire; 6.2%, South Berkshire) was equivalent to the statewide prevalence (6.0%) in 1988. The infant mortality rate in Central Berkshire County in 1988, however, was higher than the state IMR (7.9 per 1,000 live births), with 10 out of 12 infant deaths occurring in Pittsfield. The combined infant mortality rate was 9.5 per 1000 live births in 1988 in South and Central Berkshire County.

Participating Sites

Project staff recruited 96 health care and community-based agencies serving infants and children in the catchment areas (Appendix D). A total of 35 health care sites included hospital inpatient services, emergency rooms, primary care outpatient clinics, Growth and Nutrition Clinics, community health centers, and private physicians' offices (rural area only). Sixty-one community-based sites included WIC programs; Head Start programs; private day care centers (rural area only); and kindergartens (rural area only). Of 28 urban sites, 23 were health care sites. Of 68 rural sites, only 12 were health care sites and 56 were community-based sites.

Project Period

The SSPUN project implementation began in October 1987. Staff recruitment and development of the study design and protocols were completed in October 1988, and were followed by a 3-month period of pilot data collection. A 12-month data collection period began at most sites in February 1989 and was completed at all sites by May 1990. Two sites completed less than 12 months of data collection (Appendix H).

Centers for Disease Control SPUN Case Definition

The SPUN case definition was developed by the Centers for Disease Control (Trowbridge and Wong, 1990). SPUN cases were six months up to six years old (<72 months) AND lived in the catchment area AND met one or more of the following criteria:

(a) Less than the 3rd percentile for weight-for-height as compared to National Center for Health Statistics (NCHS) reference data;
(b) Hemoglobin less than 8 gms/dl and/or hematocrit less than 25%mg without hemoglobinopathy;
(c) Clinical diagnosis of Kwashiorkor;
(d) Clinical diagnosis of micronutrient deficiency;
(e) Weight loss greater than 10% of child's body weight.

See Appendix A for specific case definition criteria and tables designed by CDC to identify children with weight-for-height measures less than the 3rd percentile.

Data Collection Forms

Case Reporting Forms. The one-page "Data Intake Form" (DIF) was developed to report eligible children to SSPUN staff, and included data necessary to assess age, catchment area, and nutritional eligibility for SSPUN. An adjunct form, the "Confidential Information Record" (CIR) was designed to collect data needed to verify catchment area eligibility and to contact families of eligible SSPUN children. At some sites, information was collected via a SSPUN log rather than the DIF and CIR. Information from the logs was collected by the case coordinators, transcribed to the DIF and CIR, and reported to MDPH.

Case Interview and Medical Record Review. The "Case Interview" was developed jointly by the CDC and SSPUN project staff in four states to collect descriptive information from the primary caretakers of SPUN cases and from the medical record. Core questions, used by all four states with SPUN projects, addressed family socio-demographic characteristics, health status of the mother and child, program participation, and social/familial stress. The Massachusetts SSPUN Project added questions on state and local program participation, use of health care, employment status, and maternal social isolation. Questions on food sufficiency and on maternal isolation were drawn from the NHANES III survey (NCHS 1990, Briefel 1992). The interview was translated into Spanish and Haitian Creole. All items collected in the medical record review were also asked during the interview, excluding information about child abuse/neglect, hemoglobinopathy, and record source. Reviews of the child's medical records took place at WIC Programs, Growth and Nutrition Clinics, hospitals, emergency rooms, and/or primary care facilities.

Informed Consent and Communication Forms. Standard forms were designed to obtain informed consent from families and to facilitate communication among SSPUN staff, health care providers, and families. Consent forms included consent to participate in the interview and permission to review the child's medical record. Communication forms included: paragraphs/letters introducing the project to eligible families; a letter to providers notifying them that a child identified at their site was eligible for the project; and a referral form listing name and phone number of agencies to which the family was referred. All forms were translated into Spanish and Haitian Creole.

See Appendix M for copies in English of all data collection, consent, and communication forms.

Data Collection Protocols

Case Assessment. In Massachusetts SSPUN, children with a weight-for-age, height-for-age and/or weight-for-height less than the 5th percentile or any of the CDC case criteria "b through e" (pages 7 and 8) were considered to be at nutritional risk and were eligible to be reported to the SSPUN surveillance system. After eligibility was reviewed those children who met at least one of the CDC case criteria were considered "SPUN cases" and eligible for follow-up by a SPUN case coordinator. Information from reports on children at nutritional risk but not meeting the CDC anthropometric criteria (<3rd percentile weight-for-height) were included in the regular reports sent back to participating sites.

Identification and Reporting Protocols. Case identification and reporting protocols were developed jointly by SSPUN staff and providers at each participating site. See Appendix G for site-type protocols.

All health care and WIC sites conducted screening, identification and reporting of children over a 12-month period. Kindergarten, public preschool, private daycare center and Head Start screening were conducted once or twice during a 12-month period. Anthropometry was actively assessed at all participating sites. Lab and clinical indicators of SPUN were assessed when information was available. Community health centers, outpatient clinics, and private physicians' offices screened children for SSPUN only at well-child visits. Some sites limited screening to certain days and/or hours. A list of these sites and the days/hours is included in Appendix I.

Staff were asked to screen each child, regardless of whether they had previously been reported to the SSPUN project. Children could therefore be identified and re-reported from the same site or another participating site. The SSPUN Project maintained a Central Registry which included all case reports as well as a list of unduplicated cases.

Case Follow-Up. Once a SPUN case was identified by either SSPUN staff or site staff, the SSPUN case coordinator initiated follow-up. Case follow-up included contacting eligible families reported to SSPUN, confirming measurements as necessary, conducting the case interview, making referrals to health care and/or social services, and completing a medical record review.

Most sites required that their own staff contact primary caretakers of SPUN cases by phone to receive verbal permission to report name, address and phone to MDPH and to allow a SSPUN case coordinator to contact the family. Exceptions were hospital-based sites where case coordinators had staff privileges. At these sites, case coordinators reported name, address and phone to the SSPUN staff at the MDPH Central Office and contacted the primary caretaker directly.

Families who agreed to meet with the case coordinator did so at a home visit or in conjunction with a clinic visit. Informed consent was obtained, a medical record release form was signed, and the case interview was completed. After the interview, case coordinators referred families to appropriate health and social services in their community. "Neighborhood Services: A Resource Guide for Roxbury, North Dorchester, and Jamaica Plain" was developed by project staff and distributed to families and agencies in the urban catchment area (Appendix F). Case coordinators also completed a medical record review for each case interviewed. Record reviews were conducted at WIC Programs, Growth and Nutrition Clinics, hospital inpatient services, emergency rooms and/or primary care providers' offices.

Quality Control. SSPUN project case coordinators visited and/or talked with site contact persons each week. These contacts with participating site staff allowed SSPUN staff to pick up and review completed data forms, discuss any project issues, and provide regular reminders for site staff to identify and report children eligible for the project.

Staff at participating sites were trained by SSPUN staff in case identification and reporting and standard techniques for measuring and plotting anthropometric measurements on NCHS growth charts. Scales at all sites were calibrated, and sites lacking appropriate equipment were supplied with length/height boards and scales.

Site staff at participating sites were considered confirmed measurers if they participated in SSPUN trainings and used recommended equipment. Anthropometric measures on children reported to SSPUN by trained staff were considered confirmed and children were not remeasured and reweighed. Staff from sites that had not participated in trainings and/or were not using recommended equipment were considered unconfirmed measurers. In order to confirm measures on children reported from these sites, SSPUN case coordinators remeasured and reweighed these children at the time of interview. Only SPUN cases with confirmed measurements were considered "confirmed SPUN cases."

Reports to Participating Sites. Quarterly reports were sent to sites that screened continuously over a 12-month period. The reports included number of children reported by each site and each type of site and a list of children reported and their nutritional risk by site. See Appendix J for a sample report.

Staff at participating kindergartens, preschools, and private day care centers received reports specific to their school or center. These reports included a description of the growth status of each child and tables listing children at-risk for underweight, short stature, and/or overweight. See Appendix K for a sample report. Parents of children screened at private day care centers also received a "Parent Packet" designed by project staff. The packet included an explanation of the growth chart, a growth chart with the child's measurements plotted, and general nutrition information. See Appendix L for a sample packet.

Data Management

Data Flow. Data Intake Forms (DIF) and Confidential Information Records (CIR) were picked up from participating sites by SSPUN case coordinators and delivered to MDPH weekly. DIFs and CIRs were entered into the SSPUN data system on a biweekly basis. SSPUN eligibility was confirmed based on age, catchment area and case criteria. Completed Case Interviews were entered into the SSPUN data system six months into the data collection period for interim analysis and after the data collection period for final analysis.

See Appendix N for a description of the SSPUN data management system.

Data Storage and Confidentiality. Completed data forms were stored in a locked file cabinet accessible only to SSPUN staff. Computerized data were stored in a SSPUN directory on the IBM PC 286 hard drive. Back-up copies were also stored on floppy disks and kept in confidential SSPUN files. Case identifiers from the CIR, such as name, address and phone number of case families, were stored separately from eligibility criteria and case interview information. A data intake form number, assigned to all entries, and a central registry number, assigned to all SPUN cases, provided a link between confidential and anonymous files. Data presentations included information with no individual identifiers.

Computer Systems. A menu-driven, data entry system for information from the DIF and CIR was designed using FOXBASE+ (Microsoft 1989-1993). Anthropometric data were interactively read to a PC-based version of Computer Anthropometric Software Program (CASP) (Sullivan, 1989), where percentile calculations were completed and read back to the FOXBASE+ database. Computer-based data processing programmed in FOXBASE+ included: determination of case eligibility based on age, catchment area, and nutrition criteria; assignment of a unique computer-generated central registry number to confirmed SPUN cases; and a duplicate check and reassignment of the central registry number to SPUN cases reported more than once. Case interview data were entered and stored in a separate FOXBASE+ database. Data manipulation and report generating were completed using FOXBASE+.

Quality Control. DIFs, CIRs, and Case Interviews were coded by case coordinators and reviewed by the project manager and research analyst at DPH prior to computer entry. DIFs and CIRs were entered via the menu-driven entry system, programmed with field range checks. All entered data were cross checked against original hard copy to identify and correct entry errors.

Data Analysis

Data stored in FOXBASE+ were transformed to a SPSSPC+ data file and transferred to a COMPAC 386 for analysis. Statistical analyses included standard frequency runs, cross tabulations and the Wilcoxin rank-sum test. Most statistical analyses were completed using a standard analysis package, designed by CDC staff using EPI-INFO (Dean, 1990), and utilized by all four SSPUN states. Additional state specific analyses were completed using SPSSPC+ (SPSS Inc., 1992).

Prevalence Estimates

Both population-based and site-type specific prevalence estimates of severe pediatric undernutrition were computed. See Appendix P for a detailed discussion of methods used to construct prevalence estimates.

Population-based Prevalence Estimates. The population-based denominator was estimated from the number of children reported to be living in the urban and/or rural catchment areas based on 1990 U.S. Census data. The number of children under five years was increased by 10%, to estimate the number of children aged 6 months up to 6 years (less than 72 months). The numerator was the number of unduplicated cases with confirmed weight and height measures who were reported to the SSPUN project during the study period.

Site-Type Specific Prevalence Estimates. Two site-type specific denominators were computed to estimate the prevalence of SPUN. The two denominators calculated were: (1) Number of age and catchment area-eligible children who presented at participating sites during the 12-month data collection period, summed by type of site; (2) Number of children fulfilling the criteria in (1) who were also screened, summed by type of site. Screening was defined as being weighed and measured, with at least weight or height plotted at the first well-child visit during the data collection period. Because a child would have to be screened (weighed and measured) to be reported as a SPUN case, a prevalence estimate based only on children screened is likely to be higher than one based only on the total number of children who visited participating sites, since the latter estimate includes children who may not have been weighed and measured. See Appendix P for a detailed discussion of methods used to determine number of children screened.

The numerator for both site-type prevalence estimates was the number of unduplicated cases with confirmed weight and height measures who were reported to the SSPUN project, summed by type of site. Because some children presented at more than one type of site during the data collection period, the sum of numerators of site-type prevalence estimates was 206, and exceeded the 175 unduplicated confirmed cases used to

calculate the population-based prevalence estimate.

Case Interview Analysis

Children included in the analysis were unique SPUN cases with confirmed weight and height measurements who were interviewed during the study period. Duplicate case reports were excluded, with DIF or CIR data from the report date closest to the date of interview included in these analyses. When both medical record and interview data were available for corresponding items, data abstracted from the record was used in analyses. See Appendix O for more detail on analysis decisions.

Descriptive Data. Aggregate, rural and urban frequencies were generated for core and state-specific data. Cross-tabulations were generated for selected variables. A detailed description of categories of non-participation in food and benefits programs appears in Appendix Q.

Risk Categories. Based on case interview and medical record data, SPUN cases were grouped into one or more of the following risk categories: Chronic or recurring organic disease; antenatal factors (low birthweight and prematurity); hospitalization at time of interview; inadequate food or calories; nonparticipation in social programs; stressful life events; abuse and neglect; no known risk; and unknown risk (due to insufficient information). See Appendix R for specific data used to define these risk factor categories.

Process Evaluation

A process evaluation of the SSPUN system was undertaken to determine if the system met its objectives and to develop recommendations for the continuation or modification of the SSPUN system. The process evaluation includes an assessment of the surveillance system attributes and an evaluation of the resources required to operate the system (CDC 1989(a), CDC 1987, CDC 1988). The system attributes included in the process evaluation were as follows:

Simplicity refers to both the SSPUN system's structure and its ease of operation.

Flexibility is the ability to adapt the system to meet changing information needs without using many additional resources (time, personnel, funds).

Acceptability reflects the willingness of individuals and organizations to participate in the SPUN system.

Timeliness reflects the availability of data quickly enough for its intended use, either immediate referral and intervention efforts or long-term program planning.

Representativeness refers to the ability to generalize findings from the surveillance

data to the population of interest (low-income children ages 6 months-6 years). Representativeness is related to the completeness of case-finding and the accuracy of the data collected.

Predictive Value Positive (PVP) is the proportion of children identified as potential cases (based on SPUN screening criteria) who actually were SPUN cases.

$$PVP = \frac{\text{\# confirmed cases}}{\text{\# children identified by the case screening criteria}^2 \text{ and reported}}$$

[2] Case screening criteria included here are < 5th percentile weight-for-height; hematocrit < 25%mg; hemoglobin < 8 gms/dl; weight loss; micronutrient deficiency.

III. RESULTS

A. Case Report Results: Number, Age, Sex, and Race of Confirmed Cases

During the data collection period (2/1/89 - 5/1/90), 175 unduplicated and confirmed cases of children with SPUN were identified; 142 children were identified in the urban catchment area and 33 children identified in the rural catchment area. In the rural area, cases were reported from eight of the 23 cities and towns in the catchment area. Most of the rural case reports (25) were from Pittsfield and Great Barrington.

Sixty-one percent of the 175 SPUN children were under 24 months of age when reported. In the urban area, the greatest proportion of SPUN cases were aged 12 to 24 months. In the rural area, the greatest proportion (48.5%) of SPUN cases were ages 36 to 72 months (Table 2). Overall, there were slightly more males (52.0%) than females (48.0%)(Table 3). Of the 102 urban cases with race reported, 70% were black and 19% Hispanic. Eighty-nine percent of the rural cases were white (Table 4).

Of the 175 cases, 94.3% (165) met the case definition of weight-for-height below the third percentile on NCHS growth charts (Table 5). One of these children also met the case criterion for low hematocrit (< 25mg %). Eight children were SPUN cases based on low hematocrit and/or hemoglobin values and two children were reported with weight loss greater than ten percent of their body weight. Seventy-five percent of SPUN cases had low weight-for-age (below the 5th percentile), and 20 percent of the children had short stature (height-for-age below the 5th percentile), indicating risk of chronic undernutrition (Table 5). Almost one third of the children with low weight-for-height fell below the 1st percentile (Table 6).

B. Prevalence Estimates

Prevalence of Severe Pediatric Undernutrition

A range of estimates of prevalence of SPUN were derived using different denominators: number of age-eligible children: (1) living in the catchment area, (2) seen in a health site or community agency during the data collection period, summed by type of site, and 3) screened (weighed, measured and plotted on growth chart) at a participating site during the data collection period, summed by type of site.

Population-based Denominator. Based on estimates of the number of age-eligible children living in the catchment areas in 1990, the reported prevalence of SPUN was 1.07% in the urban area (Roxbury and North Dorchester) and 0.91% in the rural area (South and Central Berkshire Counties); with an average prevalence of 1.04% in urban and rural catchment areas combined (Table 7).

Site-Type Specific Denominators of Total Children Seen. Prevalence estimates of SPUN varied widely by type of site (Table 8). Based on an unduplicated count of children visiting participating sites within site-type during the study period, the highest site-type specific prevalences of SPUN were reported in hospital inpatient services and urban Growth and Nutrition Clinics. Estimates of prevalence of SPUN by other types of sites were less than 1.0%.

Site-Type Specific Denominators of Children Screened. Estimates of prevalence of SPUN among children screened were less than 1% at most site types, and greatest in hospital inpatient services, urban emergency rooms, and at urban Growth and Nutrition Clinics (Table 9). The proportion of SPUN cases among children screened (Table 9) was greater than the proportion among children seen (Table 8) at hospital inpatient services, and urban emergency rooms and outpatient clinics.

The size, sex, age and payor source of screened and unscreened children at six randomly selected outpatient sites was compared, to determine potential biases in the selection of children for screening (Table 10). The mean weight-for-age, height-for-age and weight-for-height was slightly lower in screened children, but this difference was not significant. A significantly greater proportion of children under 24 months and those not on Medicaid were screened.

C. Case Interview Results

Interview Description

Of the 175 confirmed SPUN cases, 110 (63%) were interviewed. Two-thirds (95) of the identified urban cases and almost half (15) of the rural cases were interviewed. Interviewed and not interviewed cases did not differ significantly by race, sex and age of child (Table 11). Although differences in race were not statistically significant, race data were missing for almost 25% of uninterviewed cases. The most common reason for not obtaining an interview was the primary caretaker's refusal to participate (Table 12). Almost one-quarter (24%) of the families of SPUN cases who were not interviewed could not be contacted after phone and repeat letter attempts.

The majority of interviews (62%) were conducted via a home visit, 21% were completed at a clinic visit, and 12% were conducted while the child was hospitalized. The average length of the interview was 30 minutes. Ninety percent (100) were conducted in English and 9% (10) in Spanish. The mother was the interview respondent for the majority of the interviews (86%); a legally appointed foster parent was the respondent for eight (7%).

Medical record reviews were completed for all but 3 of the 110 case interviews. Reasons for incomplete record reviews included refusal by the family to sign the medical record release form or inability to access records.

Sociodemographic Characteristics of Interviewed SPUN Cases and Their Families

The primary caretaker of the SPUN child was the mother or mother and relative in 83% of the families interviewed (Table 13). Most caretakers (71%) had been born in the United States or lived here for over 20 years. Nearly all of the SPUN children (94%) were born in the United States. English was the language spoken in 76% of the homes.

For nearly one-third of mothers interviewed, the SPUN child was their first baby (Table 14). Over half (59%) of the mothers had completed high school. Only 9% of mothers were less than 20 years old at the time of the SPUN child's birth. Of the 97 interviewees responding, most (85%) had household incomes below 185% of the 1988 Federal Poverty Guidelines; and 68% of the 97 respondents were below the 100% of poverty level (Table 15). Over half of the families (55%) reported zero earned income.

Responses to questions on household composition and parental employment status showed that over one-third (38%) were two-parent households and half of households (51%) were headed by a single parent (Table 15). In 49% of two-parent households, both parents were employed. In one-third of two-parent households, only one parent was working at the time of the interview.

Health Characteristics of Interviewed SPUN Cases and Their Families

Prenatal Care

Among 100 mothers reporting information on prenatal care, 73.8% were seen in the first trimester of their pregnancy with the SPUN child. Sixty-four percent (70) of these mothers received adequate prenatal care, 21% (23) intermediate care; and 6% (7) inadequate care according to the Kessner Index of Adequacy of Prenatal Care (MDPH, Advance Data 1988).

Birthweight and Prematurity. Thirty-one percent of SPUN cases were born with low birthweights (<2500 g), nine of LBW cases were very low birthweight (<1500 g) (Table 16). Twenty-four percent of cases were born at less than 37 weeks gestation. Of the premature cases, most (86%) were also low birthweight. When compared by racial group, a lower percent of white families had low birth weight (18% versus 31% overall) and premature infants (17% versus 24% overall). Thirty percent (31) of the women smoked during pregnancy: of these, 13 had infants weighing < 2500 g at birth and 10 had premature infants.

SPUN Children's Health Status. A chronic or long-lasting health problem was reported in 39% of SPUN cases interviewed (Table 16). The most common health problem reported was asthma. Chronic or recurring health conditions reported among interviewed SPUN cases are listed in Table 17. Thirty-three (30%) SPUN children were hospitalized at the time of interview or had been hospitalized in the two months prior to the Case Interview (Table 16). Reasons for hospitalization appear in Table 18.

Program Participation Among Interviewed SPUN Cases and Their Families

WIC, Food Stamps, AFDC. The majority of SPUN children interviewed had participated in one or more means-tested benefit programs (WIC, Food Stamps, AFDC) at some time during the year prior to their interview (Table 19A). Sixty-nine percent of the children had been enrolled in the WIC program, 57% had received Food Stamps and 61% had received AFDC benefits for at least one of the past 12 months. Forty-two percent of the children had been enrolled in each of the three benefit programs at some time during the past 12 months. Twenty percent of children participated in only one program in the past year with the majority (20%) enrolled in WIC (Table 19B). Twenty percent of families participated in only two programs with (14%) enrolled in AFDC and Food Stamps. Thirteen percent (14) of the children had not been enrolled in any of the three programs during the past 12 months.

In the month immediately preceding their interview, many of the SPUN children were not receiving benefits for which they may have been eligible. Half of the children were not participating in WIC or Food Stamps, and 43 percent were not receiving AFDC benefits (Table 19A). In the past month, 20% (22 children) had not participated in any of the three programs. The primary reason given for not participating in the WIC program were problems with program application and missed recertification appointments (Table 20). Lack of program outreach or information, and problems with program application, were common reasons for lack of participation in the WIC program, the Food Stamp program and AFDC (Table 20).

Early Childhood Programs. Twenty-seven percent of SPUN cases had ever been evaluated at a Growth and Nutrition Clinic (Table 21). Fourteen percent of the children with SPUN participated in an Early Intervention program at some time during the year prior to their interview. Sixty-three percent (64) of children had attended family daycare or group daycare in the past year.

Primary Health Care/Health Insurance. Of 102 households reporting, 97% (99) of households had a clinic, health center, doctor's office or other place where they took the SPUN child for check-ups or sick visits. Seventy-two percent (71) of households reported that they had taken the child for health care more than four times in the previous year.

In the thirty days prior to the interview, the majority (68%) of 102 households reported having Medicaid insurance. One-quarter of households were covered by a Health Maintenance Organization (10) or other private insurance (15). One household had no insurance.

Emergency Food Programs. Ten percent (12) of SPUN households interviewed had taken food home from an emergency food bank or pantry and 12% (13) reported that their household had no food or money to buy food in the month prior to the interview. Two households reported that the SPUN child had skipped meals on from one to three days in the past month because there was not enough food or money to buy food. A total of 22 households (20%) responded positively to one of the emergency food questions above; three of these households responded positively to two of these questions.

Stressful Life Events and Social Interactions among Interviewed SPUN Cases and their Families

Twenty-three percent of households reported a stressful life event (the loss of employment, a move, a serious illness or death in the household, or an arrest) in the six months prior to the interview (Table 22). Thirteen percent of the primary caretakers had been hospitalized and three percent had been divorced in the previous six months. Nine (8.2%) of the SPUN children had a sibling that had died and three children were currently homeless (Table 22).

The degree of maternal isolation was assessed by asking interviewees how much contact they had with friends, relatives or neighbors. Approximately 50% (56) reported that they talked on the telephone less than seven times per week. Seventy percent (66) reported visiting with friends or relatives less than three times per week, and 57% (55) did not report visiting with their neighbors on either a weekly or monthly basis. One-quarter (21) reported attending religious services once per week and 36% (36) never attended. Twenty percent (20) were members of a club or organization.

SPUN Risk Categories

Case interview questions were grouped into nine risk categories. The two categories with the greatest percentage of SPUN cases were chronic disease, with 39% (43) of the children, and antenatal factors, with 36% (36) of the children (Table 23). One-quarter of SPUN cases (24%) were categorized as abuse or neglect cases as documented by medical record review. See Appendix R for a complete definition of each risk factor category.

The majority of cases (58%) had one or two risk factors (Table 23). Sixteen percent (18) had three or four risk factors. One-quarter of the SPUN children had no definable risk factor(s); 18% (20) had no known risk, 7% (8) children had unknown risk. No differences were noted for age, race, income, or sex for children with no known risk when compared with children in other risk categories.

The 82 cases for which one or more risk factor was reported were grouped by etiologic category: organic (chronic disease, antenatal factors, hospitalization), nonorganic (inadequate food, program nonparticipation or stressful life events), or mixed (organic and nonorganic risk factors). Forty-four percent (36) of the 82 cases with a reported risk factor were purely organic; 22% (18) were nonorganic; and 34% (28) of mixed etiology. Of those cases with mixed risk factor, 17 had a chronic or recurring disease; and 11 of these 17 had abuse/neglect reported as one or more social factor accompanying the chronic disease.

D. Process Evaluation

The usefulness of the SPUN surveillance system was affected by each of the following attributes of surveillance systems; simplicity, flexibility, acceptability, timeliness and representativeness (CDC 1989(a); CDC 1988; CDC 1987).

Simplicity

The simplicity of the SSPUN system was evaluated from two perspectives: the size of the system and the design of the system.

System Size. A total of 96 sites, 35 health care sites and 61 community-based sites, participated in SSPUN (Appendix D).

Information Flow. A chart describing the flow of information from reporting site to case follow-up is shown in Appendix B. Information flow varied by type of site, primarily based on confidentiality requirements specified by participating sites. See Appendix G for site-specific protocols.

Amount and Type of Information Needed to Identify a SPUN Case. The criteria used to identify a SPUN case included a variety of anthropometric and clinical indicators of severe undernutrition (see Surveillance Methods section and Appendix A). The presence of any one indicator was sufficient to define a SPUN case. Most SPUN cases were identified based on anthropometric criteria (weight-for-height). (See Table 24). Because the 3rd percentile weight-for-height is not delineated on the NCHS growth chart, sites reported children <5th percentile weight-for-height. SPUN staff then determined growth percentiles using a PC-based version of Computer Anthropometric Software Program (CASP) (Sullivan, 1989).

Personnel Allocation for Each Aspect of SSPUN. Selected staff at participating sites were involved in most components of the SSPUN system. In addition, four Case Coordinators (2.5 FTEs in the urban area; 1.5 FTEs in the rural area) were hired by the SSPUN project to work with staff at participating sites to maintain the system, screen and report eligible children, obtain consent to interview and complete the SPUN case interview. Case coordinator time was divided about equally among these three aspects of the project, although time allocated to any one component varied considerably by type of site. The SSPUN Principal Investigators, SSPUN Project Manager (1.0 FTE), Research Analyst (0.5 FTE) and Programmer (0.5 FTE) were responsible for overall project management, quality assurance, data analysis and report preparation and distribution. Table 25 identifies the allocation of SSPUN responsibilities between staff from participating sites and staff hired directly by the SSPUN project.

Staff Training Requirements. Each staff person involved in identification and reporting of SPUN children was asked to participate in an orientation workshop conducted by SSPUN personnel (including training on the use of data intake forms, confidential information forms and logs, and training on the case definition and screening protocols). Staff involved in screening children for height and weight were asked to participate in an anthropometry training conducted by SSPUN staff (including weighing and measuring techniques, use of standard anthropometric equipment, and techniques for plotting growth charts). All 96 sites participated in orientation workshops. All sites except day care centers participated in anthropometry workshops. SSPUN staff weighed and measured children in participating day care centers.

Flexibility

The SPUN system could be adapted to find children with other diseases or conditions, by changing the reporting protocols to reflect changes in the case definition or the addition of case criteria. Such changes would require staff training. Adaptations would be more easily accomplished if the range of site types were more limited than in the current system. Fewer site types require fewer variations in protocols and therefore less on-site monitoring and training time. By limiting the number of different kinds of sites recruited for SPUN, the system could expand more readily to other regions of the state. Expansion of SPUN to other regions of the state or to the entire state would be most feasible after identifying the most efficient reporting sources for differing political, geographic, economic, administrative and demographic characteristics.

Acceptability

Program/Agency Participation Rates. See Table 26 for the number and types of programs unwilling to participate in SSPUN. The most common reasons for refusal to participate were lack of staff time, fears of violating the privacy of clients, the agency's acknowledgement that they did not routinely collect the kinds of information needed to screen children for SPUN, and the perception that severe undernutrition is not a problem in their community.

Problems and delays encountered in gaining approval from sites that did participate included developing acceptable protocols for screening (especially in sites that do not routinely screen), and convincing sites to use standard anthropometry equipment (calibrated scales and length/height boards) and to plot height and weight on a growth chart. Recruitment of hospitals and community health centers was a lengthy process due to the need for approvals by the Board of Directors and/or Human Research Review Committee at each institution.

Completeness of Casefinding and Reporting. Staff training and resources are crucial factors affecting completeness of case-finding and reporting. In order to identify children at nutritional risk, staff must have the knowledge and be willing to accurately weigh and measure infants and children and to plot and interpret growth charts. Frequent reminders to screen eligible children and report cases are needed to maintain case-finding and accurate data collection. In addition, sites which do not have access to equipment for weighing and measuring or sites which are short-staffed are less likely to identify and report SPUN cases.

Timeliness

Time From Case Report to Case Interview Completion. Overall, it took an average of 44 days between the time a child was first reported to the SSPUN system and when the case coordinator completed a case interview with the primary caretaker of the SPUN child. This time varied widely by type of site (Table 27). This also reflects the time from case identification to the time when referral was made for intervention and services. The SPUN case coordinator usually made referrals at the time of the case interview.

Time From Case Reports from Sites and Summary Reports Back to Sites. The first summary report was not sent to sites until six months into the data collection period due to complications in the development of a computer system to track and analyze case data. Thereafter, reports were bimonthly.

Representativeness

Completeness of casefinding and reporting and accuracy of the data collected influence the ability to generalize findings from the surveillance data to the population of interest, i.e. low-income children aged six months to six years living in the rural and urban catchment areas.

Completeness of casefinding and reporting. Children not using the health care and community sites participating in the SSPUN project did not have the potential to be identified and counted. Resources were not designated to assess the extent of this gap in casefinding. In the urban area, where few community-based sites participated in SSPUN, it is likely that children not using the health care system were missed. Most SPUN cases identified in the rural area were from the two largest towns in the catchment area. It is possible that SPUN cases living in towns more remote from participating SPUN sites were not identified.

Once a child presented to a participating SPUN site, only those children screened for SPUN (i.e. weight and height measured and plotted on a growth chart and/or screened for micronutrient deficiency, weight loss, or hematocrit and hemoglobin) had the potential to be identified as a SPUN case and reported.

An effort was made to estimate the number of children screened at each type of site as a proportion of total children seen at each type of site. Percent screened ranged from 100% at participating WIC programs, Head Start Programs, Growth and Nutrition Clinics, Head Start, Day Care Centers, Preschools, and Kindergartens to 2 to 24% at hospital emergency rooms. A comparison of screened and unscreened children showed that children older than 24 months and children insured through Medicaid were less likely to be screened, possibly leading to under-reporting in these groups of children (Table 10). Appendix P contains a detailed discussion of methods used to determine the number of children screened.

The following sites did not screen all children partly due to the site's decision to screen only during certain times of the day or to measure height only on selected children:

- Three hospital emergency rooms and one hospital-based outpatient clinic had limited screening hours. One site also chose to measure height only on selected children. See Appendix I for specific screening times.

Customary screening practices at a site play a major role in the identification of SPUN cases. The following factors may have resulted in under-reporting of SPUN cases:

- Heights were not routinely measured in hospital pediatric inpatient wards, emergency rooms, and "sick visits" in primary care sites, limiting completeness of identification and reporting.

- In sites that routinely measured both weight and height, only weight-for-age and height-for-age were routinely plotted on an NCHS growth chart. Weight-for-height, the indicator used for the SPUN case definition, is plotted less frequently.

- Most sites may not have routinely reported micronutrient deficiency, weight loss, or low hematocrit and hemoglobin values.

- The criteria used for low hematocrit and hemoglobin were significantly lower than the cut-offs used in standard medical practice, making it less likely for sites to screen and report children based on hematological values.

- The criteria used for low weight-for-height, less than the 3rd percentile, are not delineated on the NCHS growth charts used in standard pediatric practice. This made it more complicated for a provider to clinically identify a child with SPUN.

Accuracy of Data Collected. Staff training and resources were important factors affecting completeness of casefinding and reporting. Staff in participating SSPUN sites who were likely to be screening children were required to attend training on anthropometry and SPUN reporting procedures. All sites were provided with appropriate anthropometry equipment for measuring heights and weights. Only measurements taken by a trained

measurer were considered confirmed. SSPUN case coordinators confirmed all other measures. SSPUN case coordinators visited sites and made frequent reminders to screen eligible children and to report cases. Even with these quality control measures (see also Surveillance Methods, p. 6), it is likely that an undetermined number of SPUN cases were not identified due to measurement error and/or not reported to the SPUN surveillance system due to oversight, lack of time or other factors.

Predictive Value Positive

The predictive value positive is the proportion of children identified as being cases who actually have SPUN.

$$PVP = \frac{\text{\# confirmed cases}}{\text{\# children identified by the case screening}^{1} \text{ criteria}}$$

PVP = 175/302 = 58%

This is a relatively low predictive value positive primarily due to the fact that the anthropometric screening criterion (5th percentile weight-for-height) caused 116 children to be referred into the surveillance system who were not SPUN cases (3rd percentile weight-for-height). An additional 11 children were referred into the system as cases with measurements unable to be confirmed.

This is a low PVP, meaning that resources may be unnecessarily used to provide follow-up and intervention to non-cases. However, in the Massachusetts system, once a case was referred into the system those with weight-for-height greater than the third percentile were screened out and not followed by a case coordinator, minimizing the potential for wasted resources. In fact, the anthropometric screening criterion used was purposefully selected to cause some over-reporting to the system so that true cases would not be missed due to an error in calculating percentiles.

Completeness of Case Report Forms. The most common items missing in the data intake form were the race and ethnicity of the reported child. In addition, cases at all non-hospital based sites were reported anonymously. Name and address were collected only after receiving permission from the family, resulting in greater likelihood of missing address/census tract information, but ensuring confidentiality. Only at hospital-based sites were name and address collected at the time the child was screened for SPUN.

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[1] Case screening criteria were 5th percentile weight-for-height or hematocrit < 25%mg or hemoglobin < 8gm/dl or weight loss greater than 10% of body weight or micronutrient deficiency.

Interview Completion Rates. Of the 175 confirmed SPUN cases, 110 (63%) had a case interview completed with the parent or guardian. The reasons families were not interviewed included refusal to participate (50%), unable to contact family (24%), and language barrier (8%). (Table 12).

In 14% of the cases not interviewed, the health care provider would not allow contact with the case family. The case interview was considered a research instrument and required informed consent and assurance of confidentiality. In many of the primary care settings, parents were first approached by the primary care provider and asked to participate. Only if they consented at that level could they be contacted by the SSPUN case coordinator responsible for conducting the interview.

Completeness of Questionnaire Responses. The case interview consisted of 52 core questions and 10 medical record review items used by all four states with SSPUN projects. Of these 52 core questions, only two questions addressing the number of times the mother saw her provider during pregnancy (q.31), and monthly household income over [illegible] (q.48), were answered slightly less than 90% of the time. An additional 21 questions were added by Massachusetts SSPUN staff. The questionnaire took an average of 30 minutes to administer.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Issues Affecting Interpretation of Findings

The SSPUN project goals reflected the broad mandate of a demonstration project and were:

- to estimate the number and proportion of children with severe undernutrition (SPUN) living in an urban and rural area;
- to describe the medical, sociodemographic and program participation characteristics of undernourished children and their families;
- to develop and test a surveillance system to find and report children with severe undernutrition.

While these goals are complementary, they individually could require different study designs. A study design to achieve the first two goals typically would utilize a survey of a representative sample in a selected geographic area. A survey design would permit the precise estimation of the number and percent of children meeting the criteria for severe undernutrition. Coupled with an interview and medical record review, medical and social characteristics could be documented and compared with those of children in the sample who did not meet the definition for severe undernutrition. While periodic representative surveys are part of the National Nutrition Monitoring System for the U.S. population (Interagency Board for Nutrition Monitoring and Related Research), they are costly (Mason et al. 1984) and may not yield representative prevalence estimates for small geographic areas or ethnic groups other than Caucasian (LRSO, 1990). In order to meet the third project goal, an affordable and easy to implement surveillance system to identify and refer undernourished children would be required.

Public health surveillance systems monitor high risk, non-representative groups through sites selected for a likelihood of case finding and practical considerations including ease of implementation and ability to respond to findings. In the United States, it is more efficient to monitor the nutritional status of children followed in settings such as health centers, day care centers and kindergartens. While children not using these facilities will be missed, such surveillance systems can be implemented with existing personnel and integrated with existing systems of care. Children can be screened and those who meet the definition of undernutrition referred for evaluation and treatment. With this goal for a demonstration surveillance system in mind, the goals to estimate the prevalence of undernutrition and describe associated risk factors are compromised. An effort was made to meet all three goals of the SSPUN project even given the limitations of a surveillance design. These issues may however affect the interpretation of findings related to the three goals.

Prevalence. The estimated prevalence of low weight-for-height (below the 3rd percentile) among children 6 months to 6 years living in the catchment area was

approximately one percent. This estimate is less than three percent of the reference population that would be expected to have weight-for-height below that cutoff. However, because a service-based surveillance system was used to identify children with SPUN rather than a household survey, several gaps in case finding may contribute to this underestimate. To be identified, a child living in the catchment area would have to be seen in a program or agency located in the catchment area and participating in the SPUN project. Then, the child would have to be screened, that is, weighed and measured, and the weight, height and weight-for-height plotted on a growth chart of children of the same age and sex, and reported to the SSPUN project. At each stage, children with SPUN may be missed, so the number of cases identified may be an underestimate.

To minimize the effect of undercounting on the prevalence estimate, three estimates were developed using three denominators: the 1990 U.S. census for all children under the age of five living in the catchment areas, the number of children visiting each type of SSPUN site, and the number of children at each site who were fully screened, that is, weighed, measured and plotted on a growth chart. When prevalence estimates using the three denominators are compared, the prevalence of undernutrition rises among those seen at a participating site and those who were screened at a participating site. The derivation of latter estimates (see Tables 8 & 9) is similar to that used in the Pediatric Nutrition Surveillance System, which reports the number and percent of children with poor nutritional outcomes among those weighed and measured at participating WIC, Headstart and EPSTD Programs (Yip, 1992).

Case definition. 94% of the SPUN cases were identified on basis of low weight-for-height, suggesting that weight-for-height is a more efficient criterion for identifying SSPUN than either micronutrient deficiency (including severe iron deficiency anemia) or sudden weight loss. In primary care settings in which most pediatric surveillance systems are based, it is likely that children are more frequently screened for weight than for height or other clinical criteria. SSPUN findings point to the importance of routinely measuring weight and height, and plotting weight-for-age, height-for-age, and weight-for-height on growth charts. Estimates of undernutrition from surveillance systems that collect only weight-for-age will reflect both wasting and stunting, and these may be two distinct but related forms of undernutrition (WHO Working Group, 1986). Among SSPUN cases, a larger proportion were underweight (75%) than stunted and a small proportion (20%) were both wasted and stunted.

Risk Factors

Chronic disease. Information about chronic disease was abstracted from the medical record. If no medical record data were available, caregivers' report of chronic diseases in the child were documented. A few of the diseases documented in SPUN cases (see Tables 17, 18), were not known to be associated with undernutrition or were not necessarily

chronic conditions. This could lead to an overestimate of cases with an associated medical illness, and in fact, the proportion of children with organic risk factors was relatively higher than that noted in other case studies of children with undernutrition or failure to thrive (Peterson 1993, Rathbun 1987).

Program Participation. This variable was defined in the CDC summary table as not participating in any of the three programs (AFDC, Food Stamps, WIC) at any time in the past year. Thus this proportion will be an under estimate of poor program participation, because it will miss those children who participate in one or two programs but not a third for which they may be eligible. It will also miss those who participate sporadically and who may receive partial but incomplete benefits of the program.

B. Recommendations

1. Case Definition. The case definition of SPUN used in this demonstration project included <3rd percentile weight-for-height, <8ug/dl hemoglobin, <25% hematocrit, or any of a number of other medical criteria. Medical providers found it difficult and confusing to identify and report using a number of different criteria. In addition, the 3rd percentile is not delineated on the NCHS growth charts used in standard pediatric practice.

   - *We recommend that only two criteria be used as a SPUN case definition:*
     - *Less than the 5th percentile weight-for-height, AND/OR*
     - *Hematocrit <30 mg% or Hemoglobin <10 ug/dl.*

   - *If SPUN is defined as <3rd percentile weight-for-height, the 3rd percentile should be indicated on the NCHS growth charts. A more feasible alternative is to use <5th percentile weight-for-height to screen children at risk for SPUN, and refer for in-depth evaluation of nutritional status.*

2. SPUN Surveillance Sites. Implementation of the SPUN surveillance system was labor intensive and costly. However, a less costly adaptation of the system could be implemented to ensure that children (birth to age six) are screened for nutritional risk and children with SPUN are identified and receive intervention and follow-up.

   - *We recommend that SPUN children and other children at nutritional risk be identified for purposes of evaluation as a part of existing screening activities at WIC programs, community health centers, Early Intervention programs, High Risk Infant and Family programs and Head Start.*

   - *We recommend that efforts be made to integrate nutrition surveillance data into new or existing client databases for all DPH programs serving infants and young children, including Growth and Nutrition Clinics, WIC, community health centers, Early Intervention Programs and High Risk Infant and Family Programs.*

   - *We recommend that MDPH investigate the feasibility of including EPSDT clients in ongoing nutrition surveillance activities.*

   - *We recommend that nutrition surveillance be continued at sites which provide services to children who are less likely to access the primary care system or other public health programs (e.g., hospital emergency rooms and inpatient pediatric wards in urban and rural areas, and kindergarten and day care programs in rural areas and areas with no community health centers).*

3. Families at Risk. SPUN surveillance is often described as a system to identify children at-risk. In fact, SPUN can be considered a marker for an at-risk family: Often the child is in trouble because the family is in trouble.

- *We recommend that SPUN surveillance be used to identify both children and families at risk. Families of SPUN children benefit from a child and family assessment and referral to a variety of health care and social service supports, in addition to food and nutrition referrals.*

- *Screening for SPUN is essential even among children who are not in groups commonly considered at high risk. While minority race, poverty and single parent status are common among SPUN cases, they are not universal. Undernutrition is reported across a range of racial/ethnic backgrounds, income and education levels.*

4. SPUN and Chronic Illness. In chronically ill children, SPUN may be attributed to the disease process while psychosocial and economic factors are overlooked. Of the 28 cases with mixed etiology, 61% (17) had a chronic or recurring disease in combination with one or more social risk factors, such as abuse and neglect.

- *We recommend that SPUN children with special health care needs (disability or chronic illness) receive a complete evaluation so that an appropriate care plan can be developed to address medical, nutritional, social and economic needs of the child and family.*

5. Treatment of SPUN. Once a child with SPUN is identified, a service network must be available to provide multidisciplinary evaluation and treatment to address both the medical and social factors associated with growth delay. Efforts should be made to ensure that this service network be comprehensive, community-based, family-centered, coordinated and culturally competent.

- *We recommend that MDPH continue to support and maintain the Growth and Nutrition Clinics as multidisciplinary centers for evaluation and consultation for children with growth delay and more intensive ongoing follow-up for children with SPUN.*

- *We recommend that MDPH and Growth and Nutrition clinic staff work with early childhood providers (including WIC, Head Start, EI, VNAs, High Risk Infant Programs, primary care providers, community health centers and hospital discharge planners) to develop a network of community-based interdisciplinary teams with the capacity to identify, evaluate and treat children with growth delay, to refer to Growth and Nutrition Clinics when appropriate, and to coordinate each child's care.*

6. Reimbursement for Services. Recognizing that multidisciplinary services must be adequately funded, it is crucial to explore potential sources of funding for each member of the interdisciplinary team involved in treating the child with SPUN.

- *Investigate possibilities for third party reimbursement for multidisciplinary treatment of growth delay/SPUN, including Medicaid, EPSDT, VNA/home nursing visits, social work home visits, nutritionist services, etc.*

- *Investigate reimbursement for Medicaid case management services for families with a SPUN child.*

- *Investigate reimbursement of EI providers and HRIP providers who service a SPUN child.*

7. Training. Health care and social service providers may have limited understanding of the relationship of growth and development, undernutrition and its health consequences, nutrition screening and follow-up protocols, and multidisciplinary evaluation and treatment of the child and family.

- *We recommend that MDPH begin to identify the training needs of physicians, nurses, nutritionists, social workers and psychologists in communities across the state who are willing to be resources and/or serve on interdisciplinary teams for treatment of growth and nutrition problems.*

- *We recommend that MDPH and Growth and Nutrition Clinic staff provide ongoing technical assistance, consultation and training to community-based providers (including WIC, EI, HRIP, Head Start, community health centers) in order to develop their capacity for identification, treatment and coordination of care for children at nutritional risk.*

- *We recommend that a network of pediatric nutritionists be developed and trained to enhance the level of nutrition care available to children with special health care needs (including SPUN/FTT) in communities across the state.*

8. Referrals to Food and Nutrition Programs. Many families of SPUN children were not participating in benefit programs for which they may be eligible. In addition, a recent statewide hunger survey and Nutrition Counts, the Massachusetts Nutrition Surveillance System, indicate that many low-income families do not participate in needed benefit programs.

- *We recommend that all DPH-funded programs serving children from birth to age six provide staff training on eligibility and application processes for WIC, Food Stamps, School Breakfast Program, Summer Food Service Program for Children and local emergency food resources.*

- *We recommend that WIC program staff automatically refer women and children to Food Stamps and Medicaid, and pregnant women to Food Stamps, Medicaid and Healthy Start.*

9. Epidemiological Research. Limited data exist to describe the functional consequences of U.S. children with low weight-for-height.

   - *We recommend that U.S. based research be conducted on the functional consequences of SPUN, such as cognitive delay, increased morbidity and increased mortality.*

   - *We recommend that the Centers for Disease Control continue to fund SPUN surveillance activities in order to provide the infrastructure and staff needed to investigate the prevalence of SPUN over time, associated risk factors, and effective intervention strategies.*

REFERENCES

Allen, L.H. (1990) Functional indicators and outcomes of undernutrition. *J. Nutr.* 120:924-932.

Angle, C.R., Kuntzelman, D.R. (1989) Increased erythrocyte protoporphyrins and blood lead--a pilot study of childhood growth patterns. J. Tox. Env. Health 26:149-156.

Bithoney, W.G., J. Rathbun (1983) Failure to Thrive, in Levine, M., et al (eds.), Developmental-Behavioral Pediatrics, Philadelphia, PA: W.B. Saunders.

Bithoney, W.G., et al (1989) Prospective Evaluation of Weight Gain in Both Nonorganic and Organic Failure-to-Thrive Children: An Outpatient Trial of a Multidisciplinary Team Intervention Strategy. Developmental and Behavioral Pediatrics 10:1, 27-31.

Briefel RR, Woteki CE. (1992) Development of food sufficiency questions for the Third National Health and Nutrition Examination Survey. J Nutr Educ 24:24S-28S.

Centers for Disease Control (1972) *Ten-State Nutrition Survey 1968-1970. III--Clinical, Anthropometry, Dental*, DHEW Publication no. (HSM) 72-8131.

Centers for Disease Control (1987) Surveillance Evaluation Manual, Division of Surveillance and Epidemiologic Studies, Epidemiology Program Office, and the Surveillance Coordination Group, Atlanta, GA.

Centers for Disease Control (1988), Guidelines for Evaluating Surveillance Systems, Morbidity and Mortality Weekly Report, U.S. Department of Health and Human Services, Public Health Service, Epidemiology Program Office, Division of Surveillance and Epidemiologic Studies, Vol. 37, No. S-5, Atlanta, GA.

Centers for Disease Control (1989 (a)) Enhanced Pregnancy Nutrition Surveillance System User's Manual. CDC, Division of Nutrition, Atlanta.

Centers for Disease Control (1989 (b)) Pediatric Nutrition Surveillance System Annual Summary. CDC, Division of Nutrition, Atlanta.

Chen, L.C. (1983) Interactions of diarrhea and malnutrition. In: L.C. Chen and N.S. Scrimshaw (eds.), Diarrhea and Malnutrition: Interactions, Mechanisms and Interventions. New York, Plenum Press.

Cook, J.D., Lynch S.R. (1986) The liabilities of iron deficiency. Blood 68 (4): 803-809.

Dean AG, Dean JA, Burton AH, Dicker RC. (1990) Epi Info, Version 5: a word processing, database, and statistics program for epidemiology on microcomputers. USD, Incorporated, Stone Mountain, Georgia.

Frank, D.A., S.H. Zeisela (1988) Failure To Thrive; Pediatric Clinics of North America 35:6; 1187-1206.

Guyer, B.G., Wehler, C.A., Anderka, M.T., Friede, A.M., Bithoney, W., Frank, D.A. and Fogerty, S.A. (1985) Anthropometric evidence of malnutrition among low-income children in Massachusetts in 1983. *Mass. J. Comm. Health* Fall/Winter:3-9.

Jones, D.Y., Nesheim, M.C., Habicht, J.-P. (1985) Influences in child growth associated with poverty in the 1970's: an examination of HANESI and HANESII, cross-sectional U.S. national surveys. *Am. J. Clin. Nutr.* 42: 714-724.

Interagency Board for Nutrion Monitoring and Related Research. Nutrition Monitoring in the United States: The Directory of Federal and Nutrition Monitoring Activities. DHHS Publication No. (PHS) 92-1255-1, Hyattesville MD, 1992, USDHHS.

Kristiansson, B., Fallstrom, S.P.: Growth at the Age of 4 Years Subsequent to Early Failure to Thrive. Child Abuse and Neglect 11:35-40, 1987.

Listernick, R., K. Christoffel, J. Pace, J. Chiaramonte: Severe Primary Malnutrition in U.S. Children. American Journal of Disease of Children 139; 1157-1160, 1985.

Massachusetts Dept. of Public Health (1983) Massachusetts Nutrition Survey. Massachusetts Department of Public Health, Boston, MA

Massachusetts Department of Public Health (1985) *Catching Up: Annual Report for the Failure-to-Thrive Program in Massachusetts, 1985.* Massachusetts Department of Public Health, Boston, MA.

Massachusetts Department of Public Health Office of Nutrition (1988, 1989, 1990) *Nutrition Counts*, Massachusetts Department of Public Health, Boston, MA.

Massachusetts Department of Public Health: Advance Data Births 1988. Massachusetts Department of Public Health, Boston, MA.

Massachusetts Department of Public Health (1991, in preparation). Catching Up: Report of the Massachusetts Growth and Nutrition Clinics, FY 1985-1989. Massachusetts Department of Public Health, Boston, MA.

Mayer, J. Hunger and malnutrition in the United States (1990) J. Nutr. 120:919-923.

Microsoft (1989-1993). Foxpro Relational Database Management System for MS-DOS. Microsoft Corporation, Redmond, WA.

National Center for Health Statistics. National Health and Nutrition Examination Survey III: Data collection forms. Hyattsville, Maryland: Public Health Service. 1990.

National Center for Health Statistics (U.S. 1988 Birthweights).

New England Serve (1989) Enhancing Quality: Standards and Indicators of Quality Care for Children with Special Health Care Needs. Massachusetts Health Research Institute, Boston, MA.

Physician Task Force on Hunger in America (1985) Hunger in America: The Growing Epidemic. Wesleyan University Press, Middletown, CT.

Polhamus, B.L, K.E. Peterson, P. Miller (1989) Psychosocial and Biological Risk Factors Associated with Failure To Thrive in Children Referred for Multidisciplinary Treatment. Presented at the Annual Meetings of the American Public Health Association, Chicago.

Pollitt, E. (1975) Failure to thrive: socioeconomic, dietary intake, and mother-child interaction data. Fed. Proc. 34: 1593-1597.

Pollitt, E. (1987) A critical view of three decades of research on the effects of chronic energy malnutrition on behavioral development. In: *Chronic Energy Deficiency: Consequences and Related Issues* (Schurch, B. & Schrimshaw, N.S., eds.), pp. 77-93, International Dietary Energy Consultancy Group, Lausanne, Switzerland.

Rathbun, J.M., K.E. Peterson: Nutrition in Failure to Thrive, in Grant, R.J., J.L. Sutphen, W.H. Dietz (eds.), Pediatric Nutrition. Boston, MA: Butterworths, 1987.

Schwartz, J., Angle, C., Pitcher, H. (1986) Relationship between childhood blood lead levels and stature. Pediatrics 77 (3): 281-288.

Schwartz, J. (1987) Low level health effects of lead: growth, developmental and neurological disturbances. Proceedings of the National Conference, Childhood Lead Poisoning: Current Perspectives, December 1-3.

Sullivan K, Gorstein J. (1989) Anthro, CDC Anthropometric Software Package. Atlanta: Division of Nutrition, Centers for Disease Control and the World Health Organization.

SPSS Inc., (1992) SPSSPC+, Base System User's Guide, Version 5, Chicago, IL.

Torun, B., Viteri F.E. (1984) Protein-energy malnutrition. In: Shils M.E., Young, V.R. (eds.), Modern Nutrition in Health and Disease. Lea and Febiger, Philadelphia, PA.

Trowbridge, F.L. & Wong, F.L. (1990) Surveillance of severe pediatric undernutrition: conceptual and practical issues. *J. Nutr.* 120: 946-947.

U.S. Department of Health and Human Services, Public Health Service (1987). Surgeon General's Report, Children with Special Health Care Needs: Campaign '87. USDHHS, Washington, D.C.

U.S. Census 1980

U.S. Census 1990

Yip R, Parvanta I, Scanlon K, Borland EW, Russell CM, Trowbridge FL. Pediatric Nutrition Surveillance System--United States, 1980-1991. CDC Morbidity and Mortality Weekly Report 41 (SS-7): 1-24, November 27, 1992.

V. TABLES

Table 1. Health and Sociodemographic Characteristics of Catchment Areas

	Urban	Rural	State
Number of children < 5 years[a]	12,025	3,302	412,473
Percent children < 5 years < 100% poverty[b]	44.6	37.0	11.5
Percent low birthweight[c]	12.4	6.0	6.0
Infant mortality rate[d]	20.2	9.5	7.9

[a]Source: 1990 Census

[b]Source: 1980 Census

[c]Massachusetts Department of Public Health Advance Natality and Infant Mortality Data for Boston and its Neighborhoods 1988 (Urban)

[d]Massachusetts Department of Public Health Advance Data BIRTHS 1988 (Rural)

Table 2. SPUN Cases: Age Distribution

Age in Months[a]	Urban		Rural		Total	
	n	%	n	%	n	%
6-12 months	23	16.2	5	15.2	28	16.0
12-24 months	69	48.6	9	27.3	78	44.6
24-36 months	15	10.6	3	9.1	18	10.3
36-72 months	35	24.6	16	48.5	51	29.1
Total	142	100.0	33	100.0	175	100.0

[a]Age of SPUN child at date of measure.

Table 3. SPUN Cases: Sex Distribution

	Urban		Rural		Total	
	n	%	n	%	n	%
Males	74	52.1	17	51.5	91	52.0
Females	68	47.9	16	48.5	84	48.0
Total	142	100.0	33	100.0	175	100.0

Table 4. SPUN Cases: Race Distribution

Race	Urban[a]		Rural[b]		Total[c]	
	n	%	n	%	n	%
White, Non-Hispanic	4	3.9	25	89.3	29	22.3
Black, Non-Hispanic	71	69.6	1	3.6	72	55.4
Hispanic	19	18.6	--	--	19	14.6
Other[d]	8	7.8	2	7.1	10	7.7
Total	102	71.8	28	84.8	130	74.3

[a]n=102, missing=40

[b]n=28, missing=5

[c]n=130, missing=45

[d]Other race includes Asian, African, Cape Verdean, Haitian Creole, Indian, and Mixed Race

Table 5. SPUN Cases: Percent and Number with Low Weight-for-Height, Low Weight-for-Age, and Low Height-for-Age

	Urban (n=142)	%	Rural (n=33)	%	Total (n=175)	%
Weight-for-Height <3rd percentile	133	93.7	32	97.0	165[a]	94.3
Weight-for-Age <5th percentile	102	71.8	30	90.9	132	75.4
Height-for-Age <5th percentile	23	16.2	12	36.4	35	20.0

[a] Ten cases were eligible based on hematocrit and/or hemoglobin values (8) or weight loss (2) criteria and did not meet the criteria of <3rd weight-for-height percentile. See Surveillance Methods section and Appendix A for SPUN case reporting criteria.

Table 6. SPUN Cases: Percentile Distribution of Low Weight-for-Height

Weight-for-Height	Urban n	(142) %	Rural n	(33) %	Total n	(175) %
<1st percentile	45	31.7	10	30.3	55	31.4
<2nd percentile	42	29.6	10	30.3	52	29.7
<3rd percentile	46	32.4	12	36.4	58	33.1
≥3rd percentile[a]	9	6.3	1	3.0	10	5.7
Total	142	100.0	33	100.0	175	100.0

[a]Ten cases were identified based on hematocrit and/or hemoglobin values (8) or weight loss (2) criteria and did not meet the criteria of <3rd percentile weight-for-height. See Surveillance Methods section and Appendix A for SPUN case reporting criteria.

Table 7. SPUN Cases: Number and Percentage by Catchment Area

	Urban	Rural	Total
SPUN Cases	142	33	175
Children 6 mos - 6 yrs[a]	13,228	3,633	16,861
% Cases/Children 6 mos - 6 yrs	1.07	0.91	1.04

[a]The number of children 6 months up to 6 years was estimated as 110% of the number of children less than five years reported living in the catchment areas in the 1990 Census.

Table 8. SPUN Cases: Number and Proportion Among Children Seen by Type of Site

	Cases (n)	Children Seen (n)	%
URBAN			
Hospital In-Patient	37	853	4.34
Emergency Rooms	48	6,698	0.72
Outpatient Clinics/Community H.C.	39	5,090	0.77
WIC Programs[a]	12	8,765	0.14
Head Start Programs	1	511	0.20
Growth & Nutrition Clinics	34	104	32.7
RURAL			
Hospital In-Patient	10	265	3.77
Emergency Room[b]	0	--	--
Outpatient Clinic/Community H.C.[c]	1	1,772	0.06
Private Physicians[c]	5	6,407	0.08
WIC Programs[a]	7	1,507	0.46
Head Start	2	256	0.78
Day Care Centers	4	726	0.55
Preschools	2	219	0.91
Kindergartens	4	1,050	0.38
Growth & Nutrition Clinics	0	1	0.00

[a]Denominator based on zip code.

[b]Data unavailable.

[c]Denominator includes estimate of total well and sick visits by age and catchment area eligible children, divided by 2.7 visits.

Table 9. SPUN Cases: Number and Proportion Among Children Screened by Type of Site

	Cases (n)	Children Screened (n)	(%)
URBAN			
Hospital In-Patient	37	377	9.81
Emergency Rooms[a]			
Boston City Hospital	27	709	3.81
Children's Hospital	21	60	35.0
Outpatient Clinics/Community H.C.	39	3,306	1.18
WIC Programs[b]	12	8,765	0.14
Head Start Programs	1	511	0.20
Growth & Nutrition Clinics	34	104	32.7
RURAL			
Hospital In-Patient	10	175	5.71
Emergency Room[c]	0	--	--
Outpatient Clinic/Community H.C.[d]	1	1,599	0.06
Private Physicians	5	5,782	0.09
WIC Programs[a]	7	1,507	0.46
Head Start	2	256	0.78
Day Care Centers	4	726	0.55
Preschools	2	219	0.91
Kindergartens	4	1,050	0.38
Growth and Nutrition Clinics	0	1	0.00

[a]Prevalence estimates for urban emergency rooms reported by individual site due to differences in screening methods.

[b]Denominator based on zip code.

[c]Data unavailable.

[d]Denominator includes estimates of total well and sick visits by age and catchment area eligible children screened, divided by 2.7 visits.

Table 10. Comparison of Size, Sex, Age and Payor Source of Screened and Unscreened Children in Selected MA SSPUN Sites (n = 865)

	Median SD Score			
Size[a]	**Screened**	**Unscreened**	**Z**	**p**
Weight-for-Age	-.010	.175	-1.69	.09
Height-for-Age	-.015	.080	-.91	.37
Weight-for-Height	.120	.250	-1.55	.12
	Percent			
Sex[b]	**Screened**		**Unscreened**	
Male	73.7		26.3	
Female	74.8		25.2	
	Percent			
Age[c]	**Screened**		**Unscreened**	
6-24 months	77.6		22.4	
24-72 months	71.5		28.5	
	Percent			
Payor[d]	**Screened**		**Unscreened**	
Medicaid	69.7		30.3	
All other[e]	78.8		21.2	

[a] Wilcoxon Rank Sum Test; Weight-for-Age, missing=5; Height-for-Age and Weight-for-Height, missing=24.

[b]Chi-square = .079, $p < .78$

[c]Chi-square = 3.81, $p < .05$

[d]Chi-square = 8.84, $p < .003$

[e]All other includes HMO, private insurance, no insurance.

Table 11. SPUN Cases: Sociodemographic Characteristics of Interviewed and Not-Interviewed Cases (n = 110)

	Interviewed		Not Interviewed	
	n	%	n	%
Sex[a]	(n = 110)		(n = 65)	
Male	52	47.3	39	60.0
Female	58	52.7	26	40.0
Age in Months[b]	(n = 110)		(n = 65)	
6-12	17	15.5	11	16.9
12-24	53	48.2	25	38.5
24-36	9	8.2	9	13.8
36-48	14	12.7	9	13.8
48-60	6	5.5	7	10.8
60-72	11	10.0	4	6.2
Race[c],[d]	(n = 110)		(n = 48; missing = 17)	
White	15	18.3	14	29.2
Black	49	59.8	23	47.9
Hispanic	13	15.9	6	12.5
Other	5	6.1	5	10.4

[a]Chi-square = 2.17, p <.14

[b]Chi-square = 4.49, p <.48

[c]Chi-square = 3.34, p <.65

[d]Other race includes Asian, African, Cape Verdean, Haitian Creole, Indian, and Mixed Race.

Table 12. SPUN Cases: Reasons Families Were Not Interviewed

	n	%
Reasons for No Interview (n = 50; missing = 15)		
Primary Caretaker Refused to Participate	25	50.0
Health Care Provider Refused Contact of Family	7	14.0
Family Could Not Be Contacted	12	24.0
Language Barrier	4	8.0
Other	2	4.0

Table 13. SPUN Cases: Sociodemographic Characteristics of Primary Caretakers of Interviewed SPUN Cases

	n	%
SPUN Child's Primary Caretaker (n = 110)		
Mother	79	71.8
Mother and other relative[a]	12	10.9
Grandmother	8	7.3
Other relative	5	4.5
Legally appointed foster parent	6	5.5
Time SPUN Child's Primary Caretaker in USA (n = 110)		
< 1 year	3	2.7
1-5 years	10	9.1
6-19 years	19	17.3
≥ 20 years or born in USA	78	70.9
Country of SPUN Child's Birth (n = 110)		
USA	103	93.6
US Territory	3	2.7
Other Country	4	3.6
Language Spoken in Home (n = 110)		
English	83	75.5
Spanish	11	10.0
English & Spanish	8	7.3
Other[b]	8	7.3

[a]Mother shares primary caretaking responsibility with father (3) or grandmother (4).

[b]Other language includes Portugese, Vietnamese, and Creole (Haitian, French, Portugese).

Table 14. SPUN Cases: Sociodemographic Characteristics of Mothers of Interviewed SPUN Cases

	n	%
Mother's Age at SPUN Child's Birth (n = 104; missing = 6)		
< 20 years	9	8.7
20 - 29.99 years	56	53.8
30 - 39.99 years	36	34.6
40 - 49.99 years	3	2.9
Mother's Marital Status (n = 106; missing = 4)		
Married	38	35.8
Not married	67	63.2
Other	1	0.9
Mother's Education (n = 104; missing = 6)		
< 10 grades	22	21.2
10 - 11 grades	21	20.2
Finished High School	41	39.4
> 12 grades	20	19.2
Mother's First Baby (n = 110)		
Yes	35	31.8
No	75	68.2

Table 15. SPUN Cases: Sociodemographic Characteristics of Families of Interviewed SPUN Cases

	n	%
Percent of Poverty (n = 97; missing = 13)		
< 100%	66	68.0
100 % - 129.9%	6	6.2
130% - 184.9%	10	10.3
≥ 185%	15	15.5
Family Household Composition (n = 102; missing = 8)		
Single Parent	52	51.0
Two Parent	39	38.2
Other[a]	11	10.8
Number of Persons Living in Household (n = 110)		
2-3 Persons	20	18.2
4-5 Persons	53	48.2
6-7 Persons	25	22.7
≥ 8 Persons	12	10.9

[a]Other includes foster parents and guardians.

Table 16. SPUN Cases: Health Characteristics

	n	%
Birthweight (n = 101; missing = 9)		
< 1500 grams	9	8.9
< 1500-2499	22	21.8
≥ 2500 grams	70	69.3
Gestational Age (n = 109)		
< 37 weeks	26	23.9
≥ 37 weeks	83	76.1
SPUN Child has Chronic Disease (n = 110)		
Yes	43	39.1
No	67	60.9
SPUN Child Hospitalized in Past Two Months[a] (n = 110)		
Yes	33	30.0
No	77	70.0

[a]Includes cases hospitalized at time of interview and cases reported as hospitalized in last two months.

Table 17. SPUN Cases: Chronic or Long-Lasting Health Problems[a]

	n
Asthma	13
Pulmonary Dysplasia	2
Congenital Heart Disease	1
Congestive Heart Failure	1
Congenital Anomalies	4
Congenital Genotype Syndrome	1
Disaccharidase Deficiency	1
Gastroesophageal Reflux	1
Serous Otitis Media	4
Seizure Disorder	2
Valvular Heart Disease	2
Iron Deficiency Anemia	2
Sickle Cell Anemia	2
Tonsillitis	1
Bronchitis	1
Pneumonia	1
Colostomy	1
Blind Loop Syndrome	1
Eczema	2
Tracheal Stenosis	1
Chronic Respiratory Condition	1
Esophageal Disorder	1
Dermatitis	3
Microcephalus	1
Brain Anomaly	1
Intestinal Anomaly	1
Lack of Coordination	1
Diabetes Mellitus	1
Liver Disease	1

(continued)

[a]Respondents reported 43 children had chronic disease(s). 18 children had more than one disease reported.

Table 17 (continued)

	n
Cleft Palate with Cleft Lip	1
Fetal Intrauterine Growth Retardation	2
Nasal Cavity/Sinus Disease	1
Lead Poisoning	1
Venom (snake bite)	1
Allergy	1
Carbohydrate Metabolism Disorder	1

Table 18. SPUN Cases: Reasons for Hospitalization[a]

	n
Asthma	4
Diarrhea	2
Seizure Disorder	1
Tracheal Stenosis	1
Dehydration	4
Eye Infection	1
Otitis Media	1
Acute Nasopharyngitis	1
Pneumonia	6
Appendectomy	1
Urinary Infection	2
Seizure - Holds Breath	1
Fever	2
Rash	1
Vomiting	2
Broken Bones	1
Head Trauma	1
Upper Respiratory Infection	1
Impetigo	1
Serum Sickness	1
Sickle Cell Disease	1
Tonsillitis	1
Influenza with Respiratory Manifestation	1
Esophageal Disorder	1
Gastroenteritis and Colitis	5
Blind Loop Syndrome	2

[a]Respondents reported that 33 children were hospitalized at the time of interview or in the last two months. 28 respondents reported the reason for hospitalization. 17 reported more than one reason for hospitalization.

Table 19A. SPUN Cases: Participation in WIC, Food Stamps and AFDC

	Participant[a] in Past 30 Days		Participant[a] in Past 12 Months	
	n (110)	%[b] cases	n (110)	%[b] cases
WIC	54	49.1	75	69.4
Food Stamps	54	49.1	62	57.9
AFDC	63	57.3	66	61.1
WIC and Food Stamps	30	27.3	46	43.4
WIC and AFDC	34	30.9	49	46.2
WIC and Food Stamps and AFDC	28	26.4	44	41.5
Food Stamps and AFDC	51	46.4	59	55.6

[a]Unknown and missing responses were considered to be non-participants. Non-participants may include children who were ineligible for programs based on family income and assets.

[b] Percents collected for denominator specific to each program: WIC, n=108, missing=2; Food Stamps, n=107, missing=103; AFDC, n=108, missing=2; Remaining categories, n=106, missing=4.

Table 19B. SPUN Cases: Participation in WIC, Food Stamps, and AFDC by number of programs

	Participant in Past 30 Days		Participant in Past 12 Months	
	n	%	n	%
Participation In Only One Program				
WIC	21	19.4	22	20.4
Food Stamps	1	0.9	1	0.9
AFDC	7	6.5	2	1.9
Total	29	26.8	25	23.2
Participation In Two Programs				
WIC and Food Stamps	2	1.9	2	1.9
WIC and AFDC	6	5.7	5	4.7
AFDC and Food Stamps	23	21.7	15	14.2
Total	31	29.3	22	20.8
Participation In All Three Programs				
WIC, Food Stamps and AFDC	28	26.4	44	41.5

Table 20. SPUN Cases: Reasons for Non-Participation in WIC, Food Stamps and AFDC[a]

	WIC		Food Stamps		AFDC	
	(n)	(%)	(n)	(%)	(n)	(%)
Program application	13	23.2	18	32.1	20	42.6
Program availability	9	16.1	17	30.4	20	42.6
Program access	4	7.1	2	3.6	--	--
Missed recertification	11	19.6	n/a	n/a	n/a	n/a
Program eligibility	4	7.1	12	21.4	4	8.5
No longer eligible	2	3.6	n/a	n/a	n/a	n/a
Terminated	2	3.6	n/a	n/a	n/a	n/a
Other	10	17.9	5	8.9	2	4.2
	55	100.0	54	100.0	46	100.0

[a] Percents calculated on number of non-participants for each program. Among non-participants: missing for WIC=1; missing for Food Stamps=2; missing for AFDC=1. See Appendix S for a detailed description of Program Non-Participation categories.

Table 21. SPUN Cases: Participation in Early Childhood Programs

	#	%
Growth and Nutrition Clinic[a] (n = 100, missing = 10)	27	27.0
Early Intervention[b] (n = 100, missing = 10)	14	14.0
Family or Group Day Care[b] (n = 102, missing = 8)	64	62.8

[a]Ever participated.

[b] Particpant in past year.

Table 22. SPUN Cases: Number and Percentage Reporting Stressful Life Events

	n	%
Death of SPUN Child's Sibling (n = 108, missing = 2)		
Yes	9	8.3
No	99	91.7
SPUN Child's Primary Caretaker Hospitalized (n = 109; missing = 1)		
Yes	14	12.8
No	95	87.2
SPUN Child's Primary Caretaker Divorced (n = 108, missing = 2)		
Yes	3	2.8
No	105	97.2
Loss of Employment, a move, a serious illness or death in SPUN child's household (n = 109, missing = 1)		
Yes	25	22.9
No	84	77.1
SPUN Child Currently Homeless (n = 110)		
Yes	3	2.7
No	107	97.3

Table 23. SPUN Cases: Risk Factor Categories Among Children

	n	%
Chronic or Recurring Organic Diseases (n = 110)		
Yes	43	39.1
No	67	60.9
Antenatal Factors (low birthweight and/or premature birth) (n = 101; missing = 9)		
Yes	36	35.6
No	65	64.4
Hospitalized at Time of Interview (n = 110)		
Yes	13	11.8
No	97	88.2
Inadequate Food or Calories (n = 109; missing = 1)[a]		
Yes	13	11.9
No	96	88.1
Not Participating in Social Programs[b] (n = 109; missing = 1)		
Yes	4	3.7
No	105	96.3
Stressful Life Events (n = 110)		
Yes	16	14.5
No	94	85.5
Abuse or Neglect (n = 101; missing = 9)		
Yes	25	24.8
No	76	75.3

[a] The "Inadequate Food or Calories" risk category was defined as a family who in the past 30 days had reported no food or money to buy food and/or a child who skipped meals (in the past 30 days) due to lack of food or money to buy food.

[b] The "Not Participating in Social Programs" risk category was defined as not participating in any of the 3 programs, AFDC, WIC or Food Stamps, at any time in the past 12 months. Participation in any of these 3 programs at any time in the past 12 months would be counted as a "Yes" response.

Table 23 (Continued)

	n	%
No Risk (n = 110)		
Yes	20	18.2
No	90	81.8
Unknown Risk (n = 110)		
Yes	8	7.3
No	102	92.7
Number of Risk Categories (n = 110)		
None	28	25.5
1	37	33.6
2	27	24.5
3	14	12.7
4	4	3.6

Table 24. SPUN Cases: Criteria Generating Case Reports

SPUN Case Criteria[a]	Cases (n)
Weight-for-Height	165
Hematocrit and/or Hemoglobin	8
Weight-for-Height and Hematocrit	1
Weight Loss	2
Micronutrient Deficiency	0
Kwashiorkor	0

[a]See Appendix A for specific definitions for each criterion.

Table 25. Allocation of Staff to Each Component of the SSPUN System

Type of Site	Weight and Height Measured	Identifies Cases & Reports	Obtains Permission to Contact Family	Obtains Consent & Completes Case Interview	Analyzes Data & Prepares Reports
Hospital Inpatient	SS/CC	CC	N/A	CC	CC/PM/PI
Hospital Emergency Room	SS/CC	CC	N/A	CC	CC/PM/PI
Primary Care Outpatient Clinic	SS	SS/CC	SS	CC	CC/PM/PI
Growth & Nutrition Clinic	SS	CC	CC	CC	CC/PM/PI
Community Health Center	SS	SS	SS	CC	CC/PM/PI
Private Physician	SS	SS/CC	SS	CC	CC/PM/PI
WIC Program	SS	SS	SS	CC	CC/PM/PI
Head Start	SS/CC	CC	SS	CC	CC/PM/PI
Day Care	CC	CC	SS	CC	CC/PM/PI
Kindergarten	CC	CC	SS	CC	CC/PM/PI

SS = Participating Site Staff
PM = SSPUN Project Manager
CC = SSPUN Case Coordinator
PI = Co-Principal Investigators

Table 26. Types of Sites Unwilling to Participate in SSPUN Project

Type of Site	# Refusing	# Participating
Hospital Emergency Room	1	3
Community Health Centers	2	10
Private Physicians	6	7
Day Care/Preschool	19	23
Early Intervention	5	0

Table 27. SPUN Cases: Time from First Case Report to Case Interview

Type of Site	Time Interval (days)			
	n	Mean	Median	Range
All Sites	110	44.0	29	1-204
Hospital Inpatient	26	28.7	16	1-106
Emergency Room	26	44.9	18	1-242
Growth & Nutrition Clinic	19	31.5	10	1-126
Outpatient Clinics/Community Health Centers	26	62.7	41	6-198
WIC Programs	6	66.0	29	16-204
Private Physicians	1	4.0	4	4
Day Care	3	13.0	8	5-26
Kindergarten	3	74.3	104	11-108

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